(12) UK Patent Application (19) GB (11) 2 074 085 A

(21) Application No 8108714
(22) Date of filing 19 Mar 1981
(30) Priority data
(31) 8009232
(32) 19 Mar 1980
(33) United Kingdom (GB)
(43) Application published
28 Oct 1981
(51) INT CL³
D21J 7/00
(52) Domestic classification
B5A 1R137 1R314C1E
1R314C5 1R322 1R427
1R449 7A T13P
(56) Documents cited
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(58) Field of search
B5A
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# (54) Moulding fibrous gloves

(57) A glove is formed by dipping a hollow permeable former (10) into a slurry comprising fibres and a binder. The pressure within the former is reduced to establish a fibrous layer on the former. After the binder has been cured, the fibrous layer is coated with a layer of plastics material.

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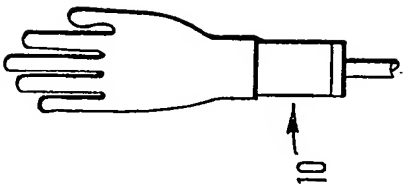
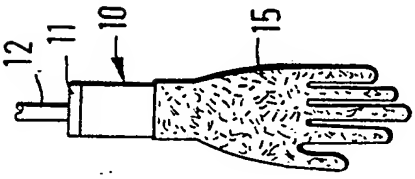



FIG.4



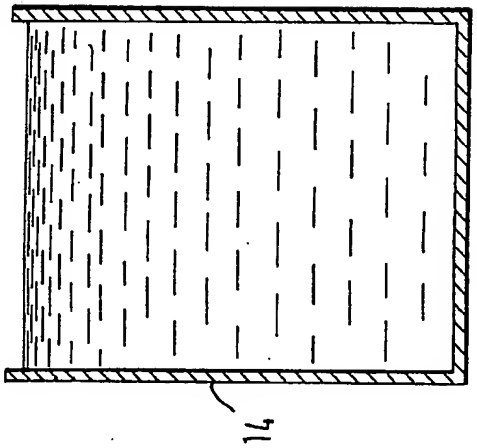




FIG.3

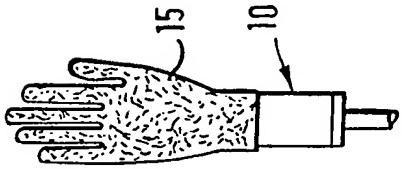
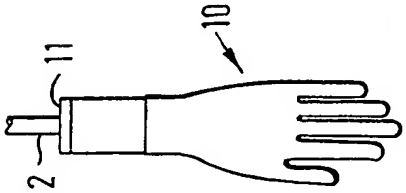



FIG. 2



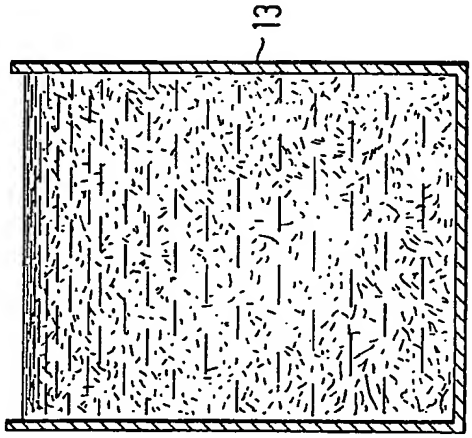




FIG. 1

SPECIFICATION

**Method of producing a hollow article, former for use in the method and glove produced by the method**

From one aspect, the present invention relates to a method of producing a hollow article, primarily, but not exclusively, a glove.

Gloves are commonly produced by stitching together pieces of sheet material cut to appropriate shapes. Gloves having stitched seams are unsuitable for protecting the hands of users from harmful liquids and for this purpose there are produced seamless gloves formed by a moulding process in which a former is coated with a plastics material or rubber composition which is then cured to produce an unlined glove. The durability of seamless gloves produced in this way is generally inferior to that of stitched gloves.

Gloves having a durability superior to that of moulded rubber gloves but which are capable of protecting users' hands from harmful liquids are manufactured by combining a stitched lining with an outer impermeable layer. The stitched lining is generally produced from a web of knitted cotton interlock. Appropriately shaped pieces of the cotton material are stitched together to form the lining and this is fitted onto a former. The former bearing the lining is then dipped in a PVC emulsion, plastisol, organosol of other curable composition to form on the outside of the lining an impermeable layer which can be cured, usually by heating.

This method of producing a composite glove has a number of disadvantages. The manufacture of the web of lining material and the production from this material of the individual glove linings represents a considerable proportion of the total cost of manufacture of the finished gloves. Errors are likely to occur during the steps of cutting out pieces of shaped material from the web and stitching these pieces together. The stitched seams may be improperly made so that they split open when a lining is applied to the former. Alternatively, the dimensions of the stitched lining may be too small to permit a lining to be fitted correctly onto a former. The strength of the lining and of the finished glove and the resistance to chemicals and abrasion are lower in the vicinity of the stitched seams than they are remote from the seams. This applies particularly to the region around the seam of the thumb crotch. The presence of stitched seams at the inside of the glove can given rise to discomfort in use, particularly when seams are imperfectly formed.

According to a first aspect of the invention, there is provided a method of producing a hollow article wherein there is provided a former having a surface which is pervious to fluid, a layer comprising discrete elements is produced on the surface of the former by exposing the surface to a supply of the elements in a fluid and establishing a pressure differential which causes the fluid to enter the former through said surface and thereby carry the elements onto the surface and thereafter the elements of said layer are bonded together to render the layer cohesive.

The article may be a seamless glove or a seamless lining for a glove.

Bonding of the elements in the layer may be effected by application to the layer of elements of a binding layer, by the action of a bonding agent applied to the elements before or during production of the layer of elements or by interaction between the elements themselves. The layer of elements may be dried and/or compressed to promote bonding together of the elements. The bonding step may render the layer impervious to fluids.

The elements incorporated in the layer preferably include filaments, for example cellulosic fibres, leather fibres or synthetic fibres or a combination of these. Whilst a substantial proportion of the elements of the layer preferably consists of filaments having a length substantially exceeding the thickness of the layer, the elements may include relatively short filaments and/or particles.

The elements may be suspended in a liquid to form a slurry into which the former is dipped.

The bonding agent may be incorporated in the slurry.

The pressure differential is preferably established by reducing to a value below atmospheric pressure the pressure within the former. The former may be hollow.

In a case where the article produced is a glove or a glove lining, a preformed wrist band may be applied to the former before the former is exposed to the supply of elements.

According to a second aspect of the invention there is provided a seamless glove formed of a layer of fibres which are bonded together.

The fibres may be bonded together by a bonding agent distributed substantially uniformly throughout the layer of fibres. Alternatively, the fibres may be bonded by a matrix in which the layer of fibres is partially embedded.

According to a third aspect of the invention there is provided a former in the shape of a hand or foot characterised in that the former is hollow and is pervious to fluids so that a liquid can be forced through a pervious wall of the former by the establishment of a pressure drop across the wall.

The wall of the former may comprise a mesh and/or sintered metal particles. Alternatively, the wall of the former may consist of a porous ceramic material.

One example of a method in accordance with the invention of manufacturing a glove will now be described, with reference to the accompanying drawing wherein:—

FIGURES 1 to 4 illustrate successive stages in the manufacture of the glove.

A former 10 having an external shape which approximates to that of a human hand, wrist and arm is mounted at its end remote from the finger tips on a carrier 11 from which there extends a tube 12. The former is hollow and the tube communicates with the interior of the former. The former is formed of a material which is pervious to water. For example, the former may be formed of sintered metal particles. Alternatively, the former may comprise an internal supporting structure covered by a layer of

fine mesh, commonly referred to as micromesh. In a further alternative, the former may be made of a porous ceramic or plastics material.

The former preferably comprises a wall of sintered metal particles between which there are defined pores having an average size within the range 3 to 90 micron. The volume of the pores typically represents 25% of the total volume of the wall and preferably represents 15% to 40% of the total volume of the wall. The thickness of the wall is preferably within the range 2 to 5 mm. In the absence of a pressure differential across the wall, water in which there are suspended fibres and a binder does not penetrate through the wall.

The former is suspended from the carrier 11 with its fingers extending downwardly and the tube 12 is connected with a pump which established inside the former a pressure lower than the ambient atmospheric pressure. The former is then lowered into a tank 13 containing a slurry which is subjected to atmospheric pressure.

The slurry in the tank 13 comprises a suspension of fibres and of a binder in water. The fibres may include staple fibres and flock. The fibres may be cellulosic, for example cotton or viscose rayon, a synthetic polyamide or of leather. Leather shavings or dust may be used. The binder may be a latex of polyvinyl chloride, an acrylic coplymer, a butadiene acrylonitrile copolymer, a polyurethane or carboxymethyl cellulose.

Because the pressure in the tank 13 exceeds the pressure inside the former 10, water flows into the former through the external surface thereof and a layer 15 comprising the fibres and binder is deposited on the surface of the former. When a layer of the required thickness has been deposited on the former, it is withdrawn slowly from the tank 13. The pressure inside the former is maintained below atmospheric pressure to ensure that the fibrous layer remains firmly on the former. After the former has been withdrawn from the tank 13, the pressure inside the former is further reduced to extract moisture from the fibrous layer and to compact the fibrous layer into a smooth uniform continuous coating. The thickness of this coating may be approximately 0.6 mm.

The former is inverted and introduced into an oven where the fibrous layer is subjected to a temperature in the region of 105° to 110°C. Whilst the former is in the oven, the pressure inside the former may be equal to the pressure within the oven. When the fibrous layer 15 has been dried, the temperature in the oven is increased to approximately 150°C to cure the binder and develop the optimum strength and softness of the fibrous layer. The former is then removed from the oven.

If a glove having a fibrous external surface is required, the pressure within the former may be increased above atmospheric pressure to release the glove from the surface of the former and facilitate removal of the glove. Alternatively, if a glove having an impervious external surface layer is required, the former bearing the fibrous layer 15 may be dipped, with its fingers lowermost, into a tank 14 containing a non-acqueous PVC plastisol, an acqueous PVC emulsion or other curable plastics material in liquid form. Alternatively, the tank 14 may contain an emulsion of natural or synthetic rubber or a polyurethane. The former is withdrawn from the tank 14 with a layer of liquid curable material adhering to the fibrous layer. Excess liquid is allowed to drain or is induced to drain from the fibrous layer and the former is then inverted and introduced into an oven with the fingers uppermost. In the oven, the glove is heated to cure the rubber or plastics material. The glove can then be freed from the former as hereinbefore described.

It will be understood that the liquid rubber or plastics material in the tank 14 permeates into the fibrous layer 15 and, when cured, bonds the fibres together. If required, the bonding agent may be omitted from the slurry in the tank 13 and bonding be effected by means only of the rubber or plastics composition in the tank 14.

Alternatively, particularly in a case where cellulosic fibres are used, bonding may be effected by interaction of the fibres themselves when the fibrous layer is compacted and dried.

The rubber or plastics composition in the tank 14 does not penetrate completely through the fibrous layer 15 to the surface of the former so that in the finished glove there is a seamless, fibrous lining which is capable of absorbing perspiration.

If required, a pre-formed wrist band may be fitted onto the former 10 prior to immersion of the former in the slurry contained in the tank 13. The fibrous layer would then be formed over the wrist band and would become bonded to the wrist band during treatment in the oven.

Hollow articles other than gloves, for example mits, boots and bags, may be formed by the method hereinbefore described using an appropriately shaped former.

In a case where the slurry in the tank 13 comprises a suspension of flock, the fibres of the flock preferably have a length within the range 100 to 400 micron. In a case where the slurry comprises staple fibres, these preferably have a length within the range 4 to 7 mm., a length of approximately 5 mm. being preferred.

A first example of a suitable formulation for the slurry in the tank 13 comprises:

Cotton flock fibres having a length within the range 120 to 140 micron 1.34 parts

Staple rayon fibres having a length of approximately 5 mm. 0.19 parts

Water 36.96 parts

A 2.5% solids aqueous solution of an acrylic copolymer free of plasticiser 38.5 parts

A 0.6% solids aqueous solution of a high molecular weight polyethyleneimine 19.25 parts

2,4,4 - trichloro - 2 - hydroxydiphenylether 0.19 parts

A 1% solution of a polyamidoamine epichlorohydrin resin 3.85 parts, all parts being by weight.

A second example of a suitable formulation for the slurry comprises:

Cotton flock fibres having a length within the range 380 to 400 microns 1.77 parts

Water 42.48 parts

4.8% solids aqueous dispersion of a butadiene acrylonitrile copolymer free of plasticiser 44.25 parts
5% aqueous solution of alum 6.64 parts
2,4,4 - trichloro - 2 - hydroxydiphenylether 0.22 parts
1% solution of a polyamidoamine epichlorohydrin resin 4.43 parts.

A third example of a formulation suitable for the slurry comprises:
Cotton flock fibres having a length 380 to 400 micron 1.54 parts
Water 36.96 parts
A 2.5% acqueous solution of an acrylic copolymer which is free of plasticiser 38.5 parts
A 0.6% acqueous solution of a high molecular weight polyethyleneimine 19.25 parts
2,4,4 - trichloro - 2 - hydroxydiphenylether 0.19 parts
1% solution of polyamidoamine epichlorohydrin resin 3.85 parts.

A fourth example of a suitable formulation for the slurry comprises:
Leather fibres 1.79 parts
Water 42.96 parts
A 1% solids dispersion of an aliphatic polyester urethane 44.75 parts
5% aqueous solution of alum 6.7 parts
2,4,4 - trichloro - 2 - hydroxydiphenylether 0.22 parts
emulsifiable fat 3.36 parts.

A fifth example of a suitable formulation for the slurry comprises:
Leather fibres 1.85 parts
Water 44.4 parts
2% solids aqueous dispersion of a butadiene acrylonitrile copolymer 46.25 parts
5% aqueous solution of alum 6.94 parts
2,4,4 - trichloro - 2 - hydroxydiphenylether 0.23 parts
Emulsifiable fat 3.5 parts.

The constituents for each of the foregoing examples of the slurry are available commercially and information as to suitable ways of preparing a substantially homogeneous slurry is available from the suppliers.

CLAIMS

1. A method of producing a hollow article wherein there is provided a former having a surface which is pervious to fluid, a layer comprising discrete elements is produced on the surface of the former by exposing the surface to a supply of the elements in a fluid and establishing a pressure differential which causes the fluid to enter the former through said surface and thereby carry the elements onto the surface and thereafter the elements of said layer are bonded together to render the layer cohesive.

2. A method according to claim 1 wherein there is also present in said fluid with the elements a bonding agent for the elements effective to bond the elements to one another when they are present in a layer on the former.

3. A method according to claim 1 or claim 2 wherein, after the layer of elements has been produced on the surface of the former, a layer of plastics or rubber composition is applied to the layer of elements.

4. A method according to claim 3 wherein the rubber or plastics composition is bonded to the layer of elements but does not penetrate through the layer of elements.

5. A method according to any preceding claim wherein the former is dipped into a slurry comprising the elements.

6. A method according to any preceding claim wherein the pressure differential is established by reducing to a value below atmospheric pressure the pressure within the former.

7. A seamless glove formed of a layer of fibres which are bonded together.

8. A glove according to claim 7 wherein the fibres are bonded, at least partly, by a matrix in which the layer of fibres is partially embedded.

9. A former in the shape of a hand or foot characterised in that the former is hollow, is substantially rigid and is pervious to fluids so that a liquid can be forced through a pervious wall of the former by establishment of a pressure drop across the wall.

10. A method according to claim 1 substantially as herein described with reference to and as illustrated in the accompanying drawing.

11. A method according to claim 10 wherein there is used a slurry substantially in accordance with one of the examples described herein.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1981.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.